What is claimed is:

1.A carrier restoration apparatus for converting a pass-band digital signal of a specified channel into a base-band digital signal where a frequency offset and a phase jitter are restored by demodulating the pass-band digital signal by a sine/cosine wave, the apparatus comprising:

a phase/frequency detection section for obtaining a phase error between constellations of a demodulated signal and constellations of a blind decision signal or a decision-directed decision signal, and extracting a polarity of the phase error;

a loop section for frequency acquisition for extracting the corresponding frequency offset by accumulating pre-calculated bandwidth values according to the polarity of the phase error, generating the digital type sine and cosine waves according to the extracted frequency offset, and then generating the base-band digital signal where the frequency offset of a carrier is acquired by demodulating the pass-band digital signal by the sine and cosine waves;

a loop section for phase tracking for extracting the corresponding phase jitter by accumulating the pre-calculated bandwidth values according to the polarity of the phase error, generating the digital type sine and cosine waves according to the extracted phase jitter, and then generating demodulated signal constellations where the phase jitter is tracked by demodulating the base-band digital signal by the sine and cosine waves;

a blind decision section for extracting the polarity of the demodulated signal constellations generated from the loop section for phase tracking, and generating blind decision signal constellations by slicing the demodulated signal constellations according to the extracted polarity; and

a decision-directed decision section for generating a decision-directed decision signal constellations matching respective signal levels of the demodulated signal constellations generated from the loop section for phase tracking.

2. The apparatus as claimed in claim 1, wherein the phase/frequency detection section operates in a blind mode for extracting the polarity by obtaining the phase error between the demodulated signal constellation and the blind decision signal constellation in order to acquire the frequency offset, or in a decision-directed mode for extracting the polarity by obtaining the phase error between the demodulated signal constellation and the decision-directed decision signal constellation in order to track the phase jitter, and further comprises a lock detection section for controlling selection of the blind mode and the decision-directed mode.

3. The apparatus as claimed in claim 1, wherein the loop section for frequency acquisition comprises:

a frequency acquisition loop filter for detecting the corresponding frequency offset $\Delta\omega$ by accumulating values of predetermined positive or negative bandwidths for frequency acquisition according to the polarity of the phase error extracted by the phase/frequency detection section;

a controlled oscillator for generating the digital type sine wave $\sin(\omega_c+\Delta\omega)$ and cosine wave $\cos(\omega_c+\Delta\omega)$ according to the corresponding frequency offset detected by the frequency acquisition loop filter; and

a frequency acquisition element for generating the base-band digital signal where the frequency offset is acquired by demodulating the pass-band digital signal PB_Data by the cosine wave $\cos(\omega_c+\Delta\omega)$ and the sine wave $\sin(\omega_c+\Delta\omega)$ generated from the controlled oscillator.

4. The apparatus as claimed in claim 3, wherein a gear shifting of the filter bandwidth of the frequency acquisition loop filter is automatically performed by a lock control signal of a lock detection section.

5. The apparatus as claimed in claim 3, wherein the frequency acquisition loop filter comprises:

a first selection section for selecting one among a plurality of pre-calculated first positive bandwidth values according to a lock control signal of a lock detection section;

a second selection section for selecting one among a plurality of pre-calculated first negative bandwidth values according to the lock control signal:

a third selection section for selecting one of outputs of the first and second selection sections according to the polarity of the phase error detected by the phase/frequency detector;

a fourth selection section for selecting one among a plurality of pre-calculated second positive bandwidth values according to the lock control signal;

a fifth selection section for selecting one among a plurality of pre-calculated second negative bandwidth values according to the lock control signal;

a sixth selection section for selecting one of outputs of the fourth and fifth selection sections according to the polarity of the phase error detected by the phase/frequency detector; and

an integrator for detecting the corresponding frequency offset $\Delta\omega$ by accumulating outputs of the third and sixth selection sections in the unit of a symbol.

6. The apparatus as claimed in claim 1, wherein the loop section for phase tracking comprises:

a phase tracking loop filter for generating the corresponding phase jitter $\Delta\theta$ by accumulating values of pre-calculated bandwidths for phase tracking according to the polarity of the phase error extracted by the phase/frequency detection section;

a phase ROM table for generating the digital type sine wave $\sin(\omega_c+\Delta\omega)$ and cosine wave $\cos(\omega_c+\Delta\omega)$ according to the corresponding phase jitter detected by the phase

tracking loop filter; and

a phase tracking element for generating the demodulated signal constellations where the corresponding phase jitter of the base-band digital signal outputted from the loop section for frequency acquisition is tracked by the cosine wave $\cos(\Delta\theta)$ and the sine wave $\sin(\Delta\theta)$ generated from the phase ROM table.

7. The apparatus as claimed in claim 6, wherein a gear shifting of the filter bandwidth of the phase tracking loop filter is automatically performed by a lock control signal of a lock detection section.

8. The apparatus as claimed in claim 6, wherein the phase tracking loop filter comprises:

a first selection section for selecting one among a plurality of pre-calculated first positive bandwidth values for phase tracking according to a lock control signal of a lock detection section;

a second selection section for selecting one among a plurality of pre-calculated first negative bandwidth values for phase tracking according to the lock control signal;

a third selection section for selecting one of outputs of the first and second selection sections according to the polarity of the phase error detected by the phase/frequency detector; and

an integrator for detecting the corresponding phase jitter $\Delta\theta$ by accumulating an output of the third selection sections in the unit of a symbol.

9. The apparatus as claimed in claim 1, wherein the blind decision section comprises:

a polarity extraction section for extracting the polarity of the demodulated signal constellation generated from the phase tracking section in the unit of a symbol; and

a selection section for generating blind decision signal constellations by slicing by two levels the demodulated signal constellations according to the polarity extracted by the polarity extraction section;

wherein pre-calculated α values and inverted $\bar{\alpha}$ values of respective quadrants are inputted to the selection section, and the polarity from the polarity extraction section is used as a selection signal.

10. The apparatus as claimed in claim 1, wherein the decision-directed decision section comprises:

a multi-level comparator for comparing levels of the demodulated signal constellations generated from the phase tracking element; and

a selection section for receiving a plurality fo level signals, selecting one among the plurality of level signals using an output of the multi-level comparator as a selection signal, and outputting the selected level signal to the phase/frequency detection section as the decision-directed decision signal constellations.

11. A carrier restoration method of converting a pass-band digital signal of a specified channel into a base-band digital signal where a frequency offset and a phase jitter are restored by demodulating the pass-band digital signal by a sine/cosine wave, the method comprising:

a phase/frequency detection step of obtaining a phase error between constellations of a demodulated signal and constellations of a blind decision signal or a decision-directed decision signal, and extracting a polarity of the phase error;

a frequency acquisition step of extracting the corresponding frequency offset by accumulating pre-calculated bandwidth values according to the polarity of the phase error, generating the digital type sine and cosine waves according to the extracted frequency offset, and then generating the base-band digital signal where the frequency offset of a

carrier is acquired by demodulating the pass-band digital signal by the sine and cosine waves;

a phase tracking step of extracting the corresponding phase jitter by accumulating the pre-calculated bandwidth values according to the polarity of the phase error, generating the digital type sine and cosine waves according to the extracted phase jitter, and then generating demodulated signal constellations where the phase jitter is tracked by demodulating the base-band digital signal by the sine and cosine waves;

a blind decision step of extracting the polarity of the demodulated signal constellations generated from the loop section for phase tracking, and generating blind decision signal constellations by slicing the demodulated signal constellations according to the extracted polarity; and

a decision-directed decision step of generating a decision-directed decision signal constellations matching respective signal levels of the demodulated signal constellations generated at the phase tracking step.

12. The method as claimed in claim 11, wherein the phase/frequency detection step extracts the polarity by obtaining the phase error between the demodulated signal constellation and the blind decision signal constellation in a blind mode for acquiring the frequency offset.

13. The method as claimed in claim 11 wherein the phase/frequency detection step extracts the polarity by obtaining the phase error between the demodulated signal constellation and the decision-directed decision signal constellation in a decision-directed mode for tracking the phase jitter.

14. The method as claimed in claim 11, wherein the phase/frequency detection step further comprises a lock detection step for controlling selection of a blind mode and a

decision-directed mode.

15. The method as claimed in claim 14, wherein the lock detection step automatically performs a gear shifting with respect to respective filter bandwidth at the frequency acquisition step and the phase tracking step.

16. The method as claimed in claim 11, wherein the frequency acquisition step comprises the steps of:

detecting the corresponding frequency offset $\Delta\omega$ by accumulating values of predetermined positive or negative bandwidths for frequency acquisition according to the polarity of the phase error extracted at the phase/frequency detection step;

generating the digital type sine wave $\sin(\omega_c+\Delta\omega)$ and cosine wave $\cos(\omega_c+\Delta\omega)$ according to the corresponding frequency offset detected at the frequency offset detection step; and

generating the base-band digital signal where the frequency offset is acquired by demodulating the pass-band digital signal PB_Data by the cosine wave $\cos(\omega_c+\Delta\omega)$ and the sine wave $\sin(\omega_c+\Delta\omega)$ generated at the sine and cosine wave generating step.

17. The method as claimed in claim 1, wherein the phase tracking step comprises the steps of:

generating the corresponding phase jitter $\Delta\theta$ by accumulating values of pre-calculated bandwidths for phase tracking according to the polarity of the phase error extracted at the phase/frequency detection step;

generating the digital type sine wave $\sin(\omega_c+\Delta\omega)$ and cosine wave $\cos(\omega_c+\Delta\omega)$ according to the corresponding phase jitter detected at the phase jitter generating step; and

generating the demodulated signal constellations where the corresponding phase jitter of the base-band digital signal outputted at the frequency acquisition step is tracked

by the cosine wave $\cos(\Delta\theta)$ and the sine wave $\sin(\Delta\theta)$ generated at the sine and cosine wave generating step.

18. The method as claimed in claim 11, wherein the blind decision step comprises the steps of:

extracting the polarity of the demodulated signal constellation generated at the phase tracking step in the unit of a symbol; and

generating blind decision signal constellations by slicing by two levels the demodulated signal constellations according to the polarity extracted at the polarity extraction step.

19. The method as claimed in claim 11, wherein the decision-directed decision step comprises the steps of:

comparing levels of the demodulated signal constellations generated at the phase tracking step; and

selecting one among a plurality of level signals according to a result of comparison, and outputting the selected level signal as the decision-directed decision signal constellations of the phase/frequency step.